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LOGISTICS CONCEPT OF OPERATIONS FOR THE MARINE FIELD LOGISTICS SYSTEM

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APPENDIX E

LOGISTICS CONCEPT OF OPERATIONS

FOR THE

MARINE CORPS FIELD LOGISTICS SYSTEM

FINAL REPORT

DECEMBER 1980

APPENDIX E
LOGISTICS CONCEPT OF OPERATIONS
FOR THE
MARINE CORPS FIELD LOGISTICS SYSTEM

Final Report

December 1980

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APPENDIX E

LOGISTICS CONCEPT OF OPERATION FOR THE FIELD LOGISTICS SYSTEM (FLS)

1. FLS DEFINITION

The FLS represents an interface of dimensionally standardized equipment and trained personnel necessary to sustain the Fleet Marine Force (FMF) to a level of logistics response or readiness consistent with the operational demands supporting mission accomplishment.

2. PURPOSE

This appendix provides a logistics concept of FLS employment that could be supportive of a projected operational scenario. It features use of FLS hardware (combat service support equipment) in support of the amphibious operation ashore. A generalized interface relationship among FLS hardware elements is portrayed in the concept. This relationship can provide the basis for possible future changes in combat service support operations.

3. BACKGROUND

The logistics concept of operations for FLS was first examined in 1977. At that time, potential use of an air pallet system was being considered. However, the decision subsequently was made by Headquarters Marine Corps (HQMC) to drop the air pallet system from the FLS. Accordingly, this revision of the logistics concept does not consider the air pallet but does address two new items which are being considered for possible employment, i.e., the container handler and the mobilizer/transporter. Cumbersome 40-foot container lengths and the attendant tonnage of such loads, if shipped to the AOA, are far less than ideal for the normal logistics support developed by Marines in the first 45 days of an operation. However, the possibility exists that DOD shipping alternatives in a given emergency could dictate that 40-foot containers be sent to the AOA, regardless of Service preference. In this situation, it would be necessary to provide the MAGTF appropriate handling and support hardware. The aforementioned new items are designed to meet this need by providing the capability to transport and maneuver container loads up to 34 tons and with 40-foot lengths.

The logistics concept depicted in this appendix is based on a Marine Amphibious Force (MAF) beachhead of 600 square miles within the Amphibious Objective Area (AOA). Generalities have been introduced to provide a broad coverage of possible logistics usage/application and hardware interfaces; therefore, it should be noted that times, distances, and quantities are only representative of this case and would have to be tailored to fit specific operational requirements as dictated by the particular event, terrain, and situation.

The conditions under which a logistics support concept is applied can significantly limit the flexibility and adaptability of supporting resources. Conversely, the conditions can reflect an idealistic operating environment wherein every action is performed without mishap and reflects an optimum time and motion study approach.

Recognizing the "real world" variables and constraints of terrain, shipping, state of readiness, and weather/climate, the logistics support capability must be flexible and responsive to the demands of the tactical situation. In attempting to tailor logistics support to long-range operational doctrine, a review of the AMPHIB-95 study was conducted in order to establish a baseline for FLS operating criteria.

In a classified memorandum, the Advanced Amphibious Study Group presented two expanded concepts of operation (Concepts A&B) based on AMPHIB-95. Two additional concepts, known as C&D, were withheld from approval pending further development. These concepts outlined an all-vertical and an initial all-surface insertion of amphibious forces into an AOA. Concepts A&B address Marine Air-Ground Task Force (MAGTF) assault elements of varying sizes that are carried ashore by combinations of surface and rotary wing craft within specific times and distances. Unclassified excerpts from the memorandum are cited below to clarify the setting.

> To be successful in the future, the offensive-minded force must possess the capability to counter five major weapons: tanks, aircraft, artillery, air defense, and antitank guided missiles. Also of great concern are electronic warfare and NBC capability.
>
> Thus, future concepts for amphibious operations must be defined and evaluated so as to support a Marine Corps position on future ship-to-shore requirements.
>
> Amphibious operations are defined as operations conducted from the sea by Naval and landing forces for the purpose of projecting U.S. influence ashore into either a hostile or nonhostile environment. Amphibious operations can be conducted during peace-time or threatening crisis of war to achieve political, military, and/or economic aims and may involve the landing of selected or total elements of the force or an amphibious demonstration.
>
> Present mid-range objective plan, amphibious requirements letter, and recently completed studies are, in fact, statements of desired ship-to-

shore lift capabilities. They fail, however, to establish a convincing requirement for the desired capabilities.

Combat service support units can be attached to battalion landing teams as needed. Only personnel, supplies, and equipment required to seize and defend initial objectives are included in assault elements. Assault elements attack up to 10 kilometers inland.

After delivery of initial helicopterborne assault elements at "L" hour, helicopters will be predominantly committed to delivery of combat support and combat service support personnel, equipment, and supplies.

Concepts A&B can be summarized as follows:

- Both provide for a combined surface/air assault element.
- Both initially make use of helicopters as assault vehicles while recognizing that repeated trips to the same landing zone may be hazardous.
- Both indicate that initial inland objectives should be no more than 10 kilometers from the coast.
- Both stress the need for early linkup and/or ground lines of communications.
- Both provide for a more realistic reserve.
- Both introduce combat support units early in the assault.
- Both call for the early placement of landing force artillery.

In addition, mobile assault elements are utilized in both concepts. From this setting/background, certain assumptions can be derived as logistics precepts for either concept A or B.

- Early reinforcement of combat elements plus early placement of landing force artillery demand that logistics elements relinquish landing priorities. This impacts on the logistics support equipment critical for early beach development, including supply storage facilities (Class I, III, and V).
- Front end loading of combat elements precludes any routine resupply from beach support areas during the first day of operations.
- Delays in introducing logistics support equipment and personnel ashore will limit the rapid beach support area (BSA) development that has been the norm historically.
- Limited BSA development, initially, will impede the movement of assets/supplies ashore and will cause a greater demand for "on call" materials and could extend the capabilities of existing ship-to-shore tactical logistics (TACLOG) beyond reasonable limits.

4. SCOPE

This appendix addresses certain FLS concepts as possible logistics support baselines that, conceivably, have the potential of eventually becoming official Marine Corps policy or procedure. The logistics support concepts, once validated, could be used as baselines to determine an optimum mix of FLS equipment required to provide responsive service and to maintain the desired material throughput. Considerations of combat loss and maintenance deadlines also should be made in order to ensure adequate allowances within IOs.

5. GENERAL CONCEPT

Logistics support during the initial stages of an amphibious assault will be in direct response to the tactical requirements. Because sophisticated, machine-intensive logistics support will not be fully implemented until shore facilities have been established, it is anticipated that all nonmobile-loaded cargo moved ashore will be breakbulk during the first 3 to 4 days. During this period, it is envisioned that a 10-day supply of Class I and Class V and a 2- to 3-day supply of Class III material can be established within the BSA. Few, if any, other classes of supply will be handled by the logistics unit during this time.

The assault echelon (AE) will be completely transported within amphibious shipping. The AE is landed by:

- Scheduled waves. Serialized personnel, equipment, and cargo dispatched to specific beaches in sequential order to arrive at a given time
- Nonscheduled waves. Serialized personnel, equipment, and cargo maintained in tactically integral units, offshore, for introduction as the situation demands
- On-call serials. Serialized personnel, equipment, and cargo selectively offloaded to satisfy specific needs ashore. Logistic support equipment, construction materials, and consumable supplies could originate from this part of the AE.

Units in the scheduled and nonscheduled waves would generally carry only mobile loaded cargo. Most of this mobile cargo would consist of consumables and high-priority organizational property. Those items that could not be mobile loaded would be stowed as breakbulk in the remaining space in the amphibious task force. In unusual circumstances, AE materials might be embarked in contracted commercial vessels. However, the majority of the remaining supplies and equipment is introduced as part of the assault follow-on echelon (AFOE). Transport of the AFOE will generally be accomplished with the use of merchant shipping.

In a "normal" peacetime scenario, a containership would be chartered by the Military Sealift Command (MSC). Included in the ship charter costs would be dockage fees, longshoreman fees, pier and pilot fees, and those costs associated with converting the vessel into a troopship.

Basic considerations for modular suiting of merchant ships are contained in the Naval Sea Systems Command (NAVSEA) Final Report on Modular Marine Transport Study (Rpt # 312-072-79). One of the conversion costs would include modifications to hatch covers (to accommodate the access modules). Another cost could involve additional insurance premiums as a result of a conversion.

The Marine Corps would contract with the port operators for container/module storage and weighing facilities, longshoremen, and stevedores. Included in these costs would be the provision of personnel to load the modules physically and array them in accordance with Marine Corps plans, to include hatch complexing and utility hookups.

Before any loading and arraying were accomplished, loading plan approval would be required from the ship owner or agent to ensure ship integrity and seaworthiness of the embarked load.

Within the above scenario, all port operations (pierside and aboard ship) are controlled, operated, and manned by the various maritime unions. In time of a national emergency or mobilization, either an Army Terminal Service (container and/or breakbulk) Company or a Naval Cargo Handling and Port Group could be tasked to accomplish the loading operations previously noted.

In any event, either Army or Navy personnel would operate the shipboard equipment LOTS
and assist in the offload of merchant ships in a Logistics-Over-The-Shore (LOTS)-type environment within the AOA.

It is during general unloading of the AFOE that the majority of FLS items would become available, commencing about D+5. Prior to this time, cargo throughput could not be D+5
maximized.

Through the D+5 time frame, logistics facilities ashore would be established, expanded, and improved as necessary. Included are the beach transfer facilities, road networks, supply and storage facilities, marshalling yards, and combat service support facilities. Once these facilities became fully operational, the shore-based units would be ready for maximum material throughput operations. Limited operations could commence sooner, consistent with the development ashore. Containerized cargo, either within standard containers or in smaller configurations arrayed into standard configurations, will significantly increase the tonnage transfer rates.

The current Southwest Asia situation portends considerable evidence to support scenarios similar to envisioned in this appendix. The requirement to accommodate merchant containerships, roll-on/roll-off ships, tankers, etc., in unimproved port or beach facilities is significant. The challenges currently being encountered relative to unloading and distribution to sustain MAB/MAF operations or advanced base operations underscores the objectives of the FLS.

5.1 Concept of Operation for Container Flow

It is envisioned that the containerized cargo will be identified at the beach and will be directed to specific storage, maintenance, or cargo transfer sites within the combat service support area(s) (CSSA). In this regard, a need exists to identify and control the movement of containers and containerized cargo efficiently. Although the current organizational structure within the FMF provides a container control section for this purpose, its manual system appears to be outmoded. The Military Standard Transportation and Movement Procedures (MILSTAMP), an automated system, was exercised efficiently during "Solid Shield-79." Some form of automated control, adopting the MILSTAMP format, would optimize the identification of containerized cargo. The orderly movement of this cargo within the CSSA, as well as to and from the beach, is totally dependent upon the FLS. Support equipment required to effect this movement has been identified within the motor transport and material handling equipment subsystem of the FLS.

Air movement of containers is also expected. However, it is recognized that aircraft, particularly the CH-53E helicopter, will be in high demand both for tactical and logistics support missions. This is of particular significance, since some container arrays involving QUADCONs, PALCONs, and shipping frames can be helicopter-lifted only by the CH-53E due to their gross weights. Airlift priorities for helicopter support will normally be directed toward tactically oriented missions, possibly delaying logistics missions. An additional restriction on the availability of CH-53E aircraft is the fact that it is the only Marine Corps helicopter capable of lifting the M-198 howitzer under all envisioned tactical conditions.

As presently planned, FLS will have three items of material handling equipment (MHE) available to lift or handle the 8'x8'x20' container/shelter. These are the lightweight amphibious container handler (LACH), the 30-ton rough terrain crane, and, the container handler when it becomes available. The latter item would also lift 8'x8'x35' and 8'x8'x40' commercial containers. The LACH has demonstrated its capability and versatility as a container handler at various representative landing craft beaching sites and in CSSAs. This equipment can operate in the surf zone in water depths up to 5 feet. The crane, on the other hand, was designed to handle breakbulk cargo and has proven extremely efficient in this role. More recently, its use has been extended to the handling of containers. In this assignment, it has a more restricted capability and must be operated in a fixed position with a limited boom reach. The container handler will provide the capability to not only load and unload containers onto and from logistics trailers and transporters, but it will be able to s k commercial containers as well. The rapid loading or unloading of convoys and maintaining a high transfer throughput will be enhanced through use of the container handler (figure E-1). Its employment in BSAs, CSSAs, and at container retrograde sites is vital to efficient operation when commercial containers are introduced into the AOA.

Once the containerized cargo arrives by tractor-trailer or mobilizer at its inland destination (in the CSSA), one of four actions will occur, namely:

- The container will be removed from the trailer/mobilizer and stored.
- The container and the trailer/mobilizer will be stored.
- The container will be removed from the trailer/mobilizer and be stripped.
- The container will remain on the trailer/mobilizer and be stripped (requires dock or ramp).

Figure E-1. Container Handler—Convoy Loading/Unloading

Should material transport assets and space permit, there may not be an urgency to immediately strip containers stored on trailers/mobilizers. However, the limited availability of container and motor transport resources will normally preclude this method. Hence, immediate stripping generally will be the rule. The unloaded supplies would then be stored in appropriate supply facilities located within the BSA/CSSA, or could be immediately consigned to forward units as the situation permits. If container stripping must be expedited, it would seem prudent not to remove the container from the trailer/mobilizer.

Certain conditions must prevail if the containers are to be stripped while on trailers. Either a loading platform or dock, which aligns closely (1 to 3 inches) with the level of the container floor, must be available to permit entry and withdrawal of the 4,000-pound rough terrain forklift (RTF), or a ramp must be constructed (currently the U.S. Army has mobile ramps in its inventory that accommodate the container unstuffing operation with forklift access to the container via the ramp). Alternatively, a level dock or platform could be provided as a deliberate construction task by force engineers.

Two methods of container stripping operations are proposed for the 4,000-pound RTF. The size of the amphibious task force, time, and available resources will influence which method or combination of methods is to be used.

Field Method. This method basically parallels current operational patterns for accomplishing logistics support buildups. Whereas supply areas are rough graded and improved as time and conditions permit, the rough terrain capabilities of forklifts, container handlers, trucks, and cranes provide unloading/loading capabilities without particular concern for platforms or loading docks. This type of logistics operation demands the versatility now inherent in MHE. The 4,000-pound forklift will be necessary for stripping containers, either on the ground or via ramp, if the container is trailer-mounted. However, assured availability of this forklift for container stripping could potentially cause some problems if meticulous planning and attention to the detailed use of resources are not exercised. This results from the probable reliance on the 4,000-pound RTF as both an auxiliary mover for the M—198 howitzer between local gun positions and as a general piece of MHE within artillery units. This observation considers the limited numbers of MHE which cause priority assignment and scheduling to be exacerbated as operations ashore progress and equipment deadline rates increase. In the field method, a LACH, 30-ton crane, or container handler could be used to position the container. After cargo is removed, the container would then be placed into a retrograde pipeline either by direct movement back to the containership or via temporary storage in a specially designated lot. Retrograde lots will be planned in CSSA development.

Platform Method. This method requires the erection of a platform or transfer dock to permit container stripping. The facility (either prefabricated or constructed on site) could be timber, concrete, steel, or a combination of these materials. In addition, soil stabilization efforts would be necessary in the immediate vicinity of the platform. This methodology allows forklifts to operate on the platform. RTFs would be used to move the unloaded supplies to field dumps adjacent to the platform. This method facilitates the retrograde movement of containers, particularly if they remain trailer/mobilizer-mounted. Although the method appears adaptable to MAF-sized operations, it probably is impractical for MAU operations and would be questionable for use by MAB. This premise is predicated upon the smaller quantities of supplies involved and the reduced probability of having container shipping available.

If the platform method were adopted, the following actions would be required:

- Consideration of platform construction and/or erection specifications.
- Identification of equipment dedicated for platform operations (Possible use of commercial forklifts).
- Development of storage facilities and construction alternatives to optimize platform and FLS equipment use.
- Development of operational and cost analysis data to determine the feasibility of using a ramp as an augmenting capability.
- Updating the Civil Engineering Laboratory Technical Note (TN No. N-1514) titled "Earthwork Construction in Support of a Marine Amphibious Force—A Case Study," dated January 1978. Detailed construction requirements and layouts must be identified for both the field and platform methods. In addition, they must be evaluated in order to determine an optimal operating procedure for material storage and movement during MAF operations.

Ramp Assist Augmentation. The use of ramps to unload containers from trailers has been pursued by the Army. This capability can augment both the field and platform methods. It is viewed as an asset only in those situations where forklifts are available without loading platforms and where containers cannot be removed from the trailer. It could also be used in overflow situations where queuing for platform space is a problem.

LACH. The rationale for LACH procurement quantities is predicated on a scenario that does not envision platform methodology as discussed above. Consequently, a determination of the mode of container transfers and unloading operations possibly could alter the quantities of LACH.

Storage Facilities. This concept of operations envisions one expeditionary airfield, two CSSAs, and two BSAs developed with a conventional supply storage arrangement. Such an arrangement is similar to supply support storage areas experienced in Southeast Asia in the 1960's and early 1970's. However, if a platform method were employed at BSA or CSSA locations for container operations, there would be a need to modify the operational concept to include storage facility layouts, type of equipment, and traffic patterns in order to establish a responsive inventory of FLS items to meet operational demands. A depiction of a conceptual platform layout is shown in figure E-2. Figure E-3 shows a generalized CSSA schematic. General planning considerations for the CSSA layout, depicted in figure E-3, are as follows:

- Loading dock located adjacent to Class I and Class V storage and close to the main supply route (MSR), as these classes represent the greatest weight and density.
- Logistics operations command post adjacent to container unloading and convoy staging area.
- Motor Transport and MHE support equipment maintenance areas (organizational assets) adjacent to high traffic work areas (loading dock, Class I and Class V).
- Cold storage central to rations, medical storage, and graves registration.
- Landing zones for medical evacuations, water, rations, and ammunition are central to logistics operations control.
- Container retrograde adjacent to unloading dock.
- Separation between Class V and Class III.
- Water point, showers, and bulk laundry set up in general proximity to one another (water point generally upstream from laundry/showers).
- MSR maintained for two-way traffic. Vehicle turnarounds planned for large tractor-trailer combinations.
- All third- and fourth-echelon repair facilities located in the same general area in proximity to Class IX storage/issue point.
- Graves registration sited in proximity to medical.
- Administrative billeting/messing areas in relative proximity to work/duty areas and separated from Class V and III.

Commercial Container Handling. The stripping of cargo from commercial containers could be accomplished by commercial forklifts within the BSA/CSSA, provided platform construction is accomplished. An obvious advantage of transporting containers to a CSSA storage facility directly from the beach transfer point is the one-time handling of cargo; however, timing, MSR condition, container handling site preparation, motor transport, and MHE assets will determine the feasibility of this effort. The handling of 20-foot commercial containers at the surf line is the designed mission of the LACH. Further LACH application could conceivably take place in other areas involving container operations. These other areas could include supply dumps adjacent to expeditionary air fields (EAFs), combat service support areas, or beach support area supply dumps. However, obvious difficulties in transporting the LACH over any significant distance limit its overland responsive-

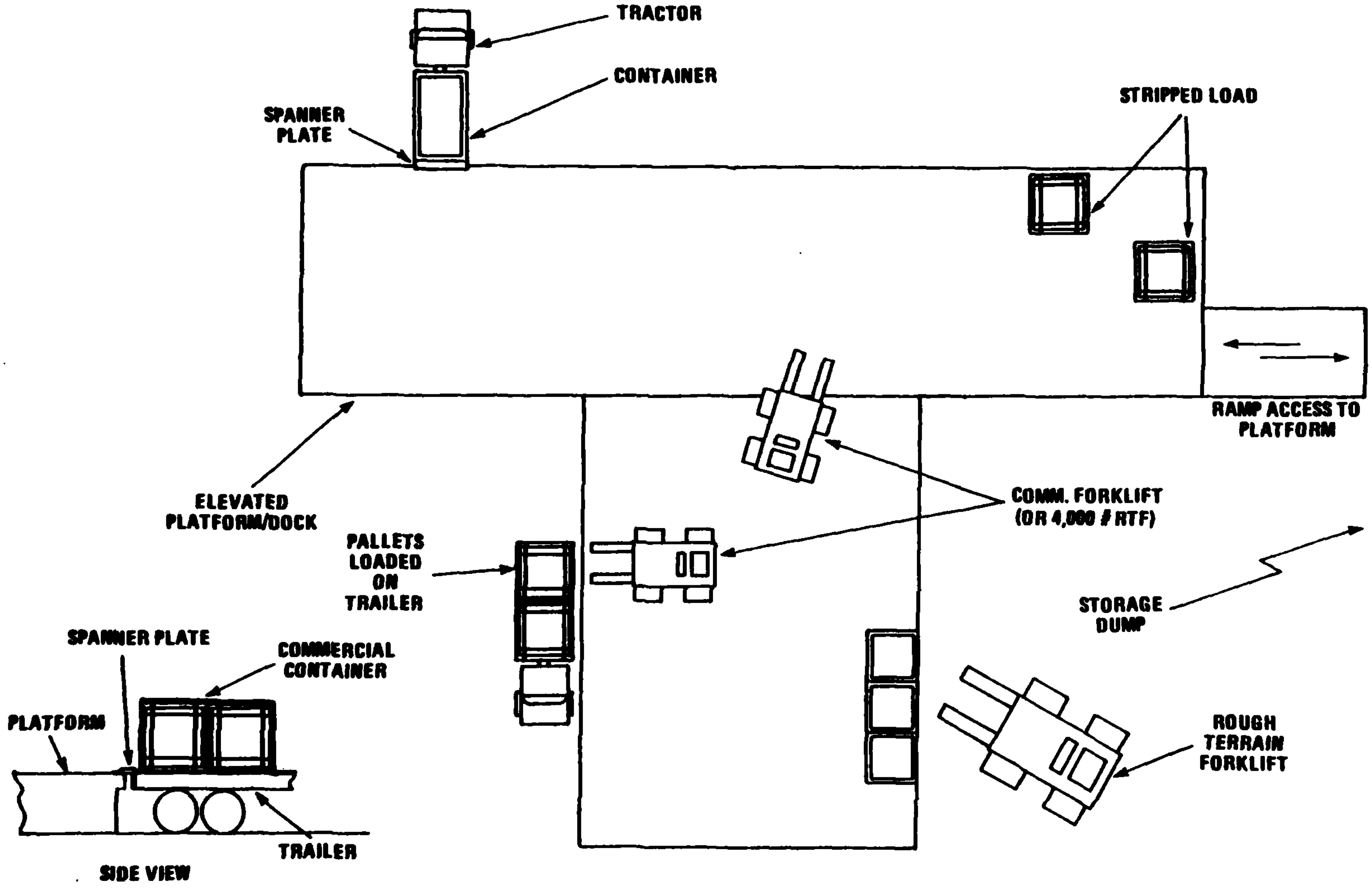

Figure E-2. Loading/Unloading Platform/Dock

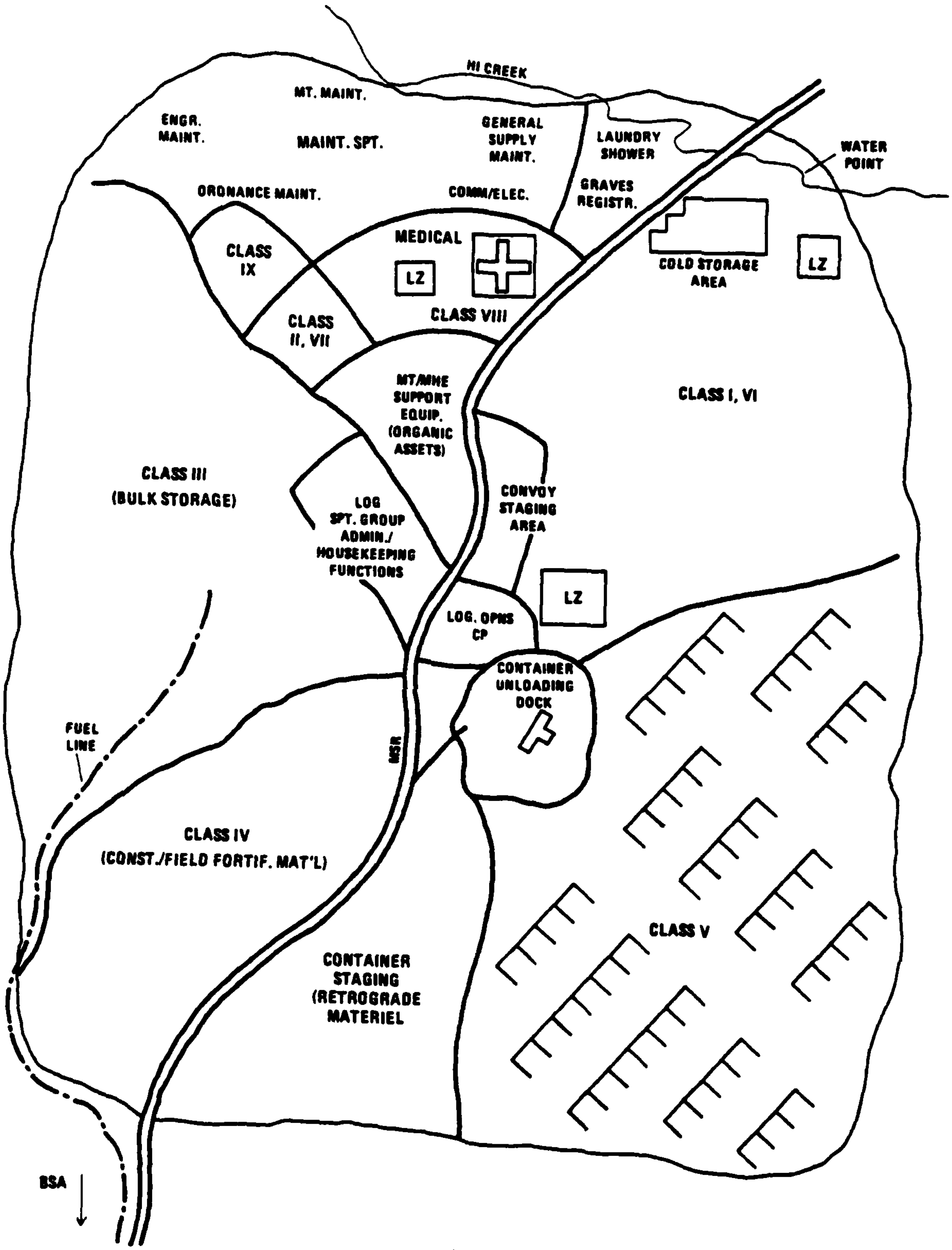

Figure E-3. Combat Service Support Area Schematic (Not to Scale) ness. In this regard, transport of the LACH in the disassembled configuration and its assembly at the site of intended use would be a normal deployment consideration.

Current Marine Corps planning for the movement of AFOE bulk material is predominantly centered upon the use of 20-foot commercial containers. However, the producers and shippers of commercial containers are increasingly employing larger 40-foot containers. Current commercial inventory levels favor the 20-foot version by about a 2:1 margin. However, there are indications that this could change in the future. To ensure the Marine Corps' continued ability to interface with whatever is available in commercial containers, use of the container handler is necessary.

5.2 Concept of Operation for Service Support Modules

Under the FLS concept, many service support items of equipment have been dismounted from dedicated trailers and vehicles. This has reduced overall equipment maintenance requirements and costs, improved trailer and prime mover availability, and enhanced employment flexibility for their respective functional roles. Further, the service support items have been modified and configured in modular form to permit their enclosure in dimensionally standardized ANSI/ISO containers, shelters, and shipping frames. These service support modules interface with and are dependent on the other FLS subsystems, i.e., container, shelter, motor transport, and material handling equipment. The concept for their employment is dependent upon an intermodal transport capability within the AOA. This may employ either air or ground transportation for delivery of the modules to intended users. In some cases, additional modules may be required to provide fuel, water, power, or other support to a functional service module. The following are specific service support functions which are being modularized:

Laundry and Shower Facilities. The combined laundry and bath unit (CLABU) was originally conceived as a laundry and shower capability colocated within one 8'x8'x20' container. However, due to the requisite size of the dryer, it was expanded into two containers with each function located separately. The CLABU requires up to 200 kW power from an external generator. The laundry and bath units can function together in the same general location or separately. The laundering capability will accommodate 250 personnel in four hours, based on an average load of five pounds of clothing per person. To cycle that number of personnel through the bath unit of the CLABU would be difficult as it would permit only four minutes for showering per person in order to reach the same level of processing efficiency.

In addition to showering, personnel drying off and dressing in fresh uniforms would do so in an area of approximately 50 square feet within the 8'x8'x20' shelter. This would cause the area to become congested rapidly and queuing would result. Accordingly, if an accelerated showering pace is required, an additional area for dressing/drying may be necessary, particularly in cold climates. Tents or other shelter facilities are candidates for such ancillary functions such as the storage of boots, valuables, and weapons. Towel supply in rear areas where CLABUs are set up would be an additional load on the CLABU laundering unit. Drying/dressing areas would require duckboard or pallet decks to allow reasonable changing conditions for individuals exiting the shower area. Setup time and drying area needs tend to affect adversely the potential use of CLABUs in forward areas where infantry companies might be serviced in "rapid" order; however, such use is not ruled out.

Use of the containerized CLABU in a modular suiting arrangement aboard merchant shipping for troop support and its transportability by vehicle, helicopter, and surface craft enhance its versatility. Recycling the water in both shower and laundry modules is an additional advantage. Standard water sources or a 1,000-gallon water module may be positioned for use with the CLABU when it is emplaced ashore. The 1,000-gallon water module will provide sufficient water to maintain the waste water recycling makeup for a CLABU. The associated 1,000-gallon water module, a 200-kW generator, MEPDIS electrical distribution equipment, and skilled personnel needed to operate and maintain the CLABU should be fully understood and not taken lightly by the planner coordinating its transport, handling, and operation. A less costly bulk laundry and separate bath/shower unit will be placed in more static positions to support all other MAF elements.

Fuel/Water Storage. The fuel/water storage module is a rigid tank having a nominal capacity of 1,000 gallons. It is mounted in a 4'x6-2/3'x8' shipping frame, which is commonly known as a "SIXCON". When arrayed in a 2x3 configuration, the SIXCON is compatible with the international dimensional standards of an 8'x8'x20' container. Additionally, each SIXCON is fitted with International Organization for Standardization (ISO) corner fittings for arraying and restraint. These intermodal features ensure its compatibility with land, rail, air, and ocean movement.

Each module is designed for a gross weight of 10,000 pounds. This restricts the loaded module handling interface to the Marine Corps' largest forklift and to the 30-ton crane. Intermodal transportability of six arrayed SIXCONS, fully loaded to 60,000 pounds, is not possible due to the resultant gross weight. ISO limitations specify 44,800 pounds as being the maximum limit for an 8'x8'x20' configuration. Furthermore, the currently available Marine Corps helicopter (CH-53E) has a maximum lift capability of 32,000 pounds. Therefore, it will be necessary to transport six arrayed SIXCONs in an empty or partially loaded condition. Care must be exercised with partial loads to ensure a proper center of gravity and to prevent spillage and sudden weight shifts. Consequently, field use, particularly when helicopters are employed, would dictate the transport of full individual modules or partially loaded arrayed modules as a general rule. Three fully loaded SIXCONs would represent a CH-53E maximum lift. Similarly, a three SIXCON array transported by a logistics trailer would be the norm.

Movement of the modules to a dispensing point (unit or supply point distribution) generally will be achieved by logistics vehicles. MHE or SIXCON lifting/jacking stands will be employed to unload the vehicles and spot the modules at an appropriate place. Truck turnaround areas, relatively level storage facilities, and efficient vehicle access are siting requisites.

Water dispensing is generally performed by gravity feed, whereas in the case of fuel, it is by mechanical pump action. For the latter purpose, a 100-gpm pump has been configured within a SIXCON shipping frame. In many instances, one pump module will be arrayed with five storage modules. This provides a complete storage and dispensing system packaged in an 8'x8'x20' envelope. The current pump is diesel driven; however, investigations are underway to ascertain the feasibility of using a lower capacity pump powered by a 12-volt vehicle system. TAFDS dispensing equipment will be required to service aircraft, although the fuel pump can transfer fuel into bulk storage tanks with proper fittings and adapters.

Utilization of the new 1,000-gallon water storage module and optional pump module will differ significantly from the 400-gallon water trailer presently used. Preventive maintenance and operation of the pump will require trained personnel. Diesel fuel is required for the pump. Use of a multimodule hookup will require trained personnel (MOS 1121) during installation and removal of empty modules. A slow but effective gravity flow method of unloading will be used when the pump module is excluded (normally the case).

Fuel storage and fuel dispensing systems must be operated by trained personnel (MOS 1391), and equipment control and operation should effectively interface with current bulk fuel units and equipment respectively. Single, gravity dispensed modules will not require bulk fuel personnel; however, normal fire/spark prevention and safety must be exercised. Where a pumping module is involved or when two tanks must be employed in maintaining leak-free hookups, bulk fuel personnel are required. Grounding rods and clips will be required for pumping operations and dispensing. Care must be taken to ensure against product contamination. This is particularly important where multiproduct use is the rule. Diesel fuel is easily contaminated by a small amount of high octane fuel residue in "empty tanks."

Such contamination can cause preignition of diesel engines and render large amounts of fuel unusable.

Generally, single modules will be placed in locations where fuel consumption less than 250 gallons per day is planned (e.g., small motor pools, dining facilities, and utility services). Larger installations, such as vehicle parks, airfields, and VSTOL pads, will require multimodules or normal bulk fuel equipment installation such as AAFS components or TAFDS. These larger installations will rely on 22½-ton logistics trailers to transport fuel/water storage modules. There would be a maximum of 3 to 4 filled modules per trailer. If MHE is unavailable at the site for unloading, the 100-gpm pump can be used to transfer the fuel to empty modules that are not trailer mounted.

Sanitation Unit. The current prototype of the sanitation unit consists of two urinals, two commodes, and associated waste treatment equipment. These components are mounted on four standard-sized pallets which can be configured within an 8'x10' area. Consequently, two sanitation units are envisioned in the 20-foot shelter. Emplacement of these palletized components outside of a 20-foot shelter, such as in a bunker, is also envisioned.

While the sanitation unit offers the unique capability of reducing human waste to an innocuous ash and odorless vapor, its resource requirements must be considered. Its processing feature of 50 men/day/unit carries an associated requirement that organizations properly operate, control, and regulate use of the unit. Power requirements for a single unit approximate 10 kW. Exhaust temperatures of 800°F dictate a judicious venting requirement. Future developmental efforts may direct some of this exhaust into the evaporators thereby reducing power requirements and lowering temperature emissions. An audible alarm system will be required to ensure positive control over the usage of each unit in order to ensure its continued efficient functioning and proper sanitation. Under currently planned allocations, approximately 80 percent of the MAF population will employ traditional methods for disposal techniques. Conversely, the unit offers considerable potential for shipboard adoption within the modular suiting concept for merchant vessels. In a shipboard environment, a flush water bypass feature eliminates the incineration process and thereby significantly reduces the power requirement that is attendant in its field use.

Normally, use of the sanitation unit within the AOA should be where ease of transport and emplacement are considerations. The selection of candidate organizations and sitings would favor those where relocation is minimal (Hospital Company, MAF, Division and Wing Headquarters, BSAs, Force Service Support Group Headquarters, and other supporting units). While offering minimal relocation or displacement requirements, these organizations contain relatively large populations where use of sanitation units could be maximized and field sanitation problems generated by other methods of waste disposal reduced.

Other. Additional service support functions, including the water purification unit, soil stabilization, Marine Corps field feeding system, and dump modules, discussed in appendix A, provide required combat service support to the FMF. The utility of these elements dictates that careful logistics planning and integration of support assets be accomplished so that the required services are provided when and where they are needed. A schematic of a typical field feeding system set-up is displayed in figure E-4.

5.3 Concept of Operation for Large Shelters

General. The need for adequate large shelters coincident with specific functional logistics requirements has been articulated in ROC statement No. Log 1.20. This led to development of the Marine Corps Expeditionary Shelter System (MCESS), which will soon be introduced into the FMF. The large versions of the MCESS offer a considerable challenge as regards erection and dismantling. A detailed analysis of the labor requirements, associated skills, and equipment needed for such operations is given in tab 1 of this appendix. In essence, the 60'x128' shelter (largest of 3 sizes) requires appreciable time and manpower to erect when deployed to nonimproved areas; however, the erection times and labor force would be reduced if concrete aprons, macadam surfaces, or other well drained, level hardstands were available.

Transport. The transport of these large shelters from the beach to their erection site would be accomplished normally with transporters/mobilizers. Logistics trailers might be used, although an extended overhang beyond the trailer bed extremities would necessitate special operational procedures to ensure safe operation. A procurement waiver request to permit flatracks to be made available at the time of the shelters introduction into the FMF has been approved and should help obviate the movement difficulty. However, the 40-foot flatrack, when placed in the FMF during FY83, could pose special handling considerations if acquisition of 40-foot trailers or mobilizers is not executed.

Advanced Base Functional Components (ABFC). Interface of the 60'x128' shelters with the ABFC of the Navy is significant. The shelter interface is magnified when attendant features such as concrete footings, aprons, and decks, as well as hardstands, road networks, and power sources are considered.

In the event that Marine Corps units were to retrograde from an area where other U.S. forces were to remain, consideration of an interservice agreement to transfer the shelters appears desirable rather than resorting to the dismantling of large MCESS shelters and subsequent erection of new shelters. This proviso assumes that the remaining shelters are suitable for the incoming force and that an in-kind replacement is made by the receiving service. Normally, however, the 32'x73' and 20'x33' shelters would be dismantled and retro-

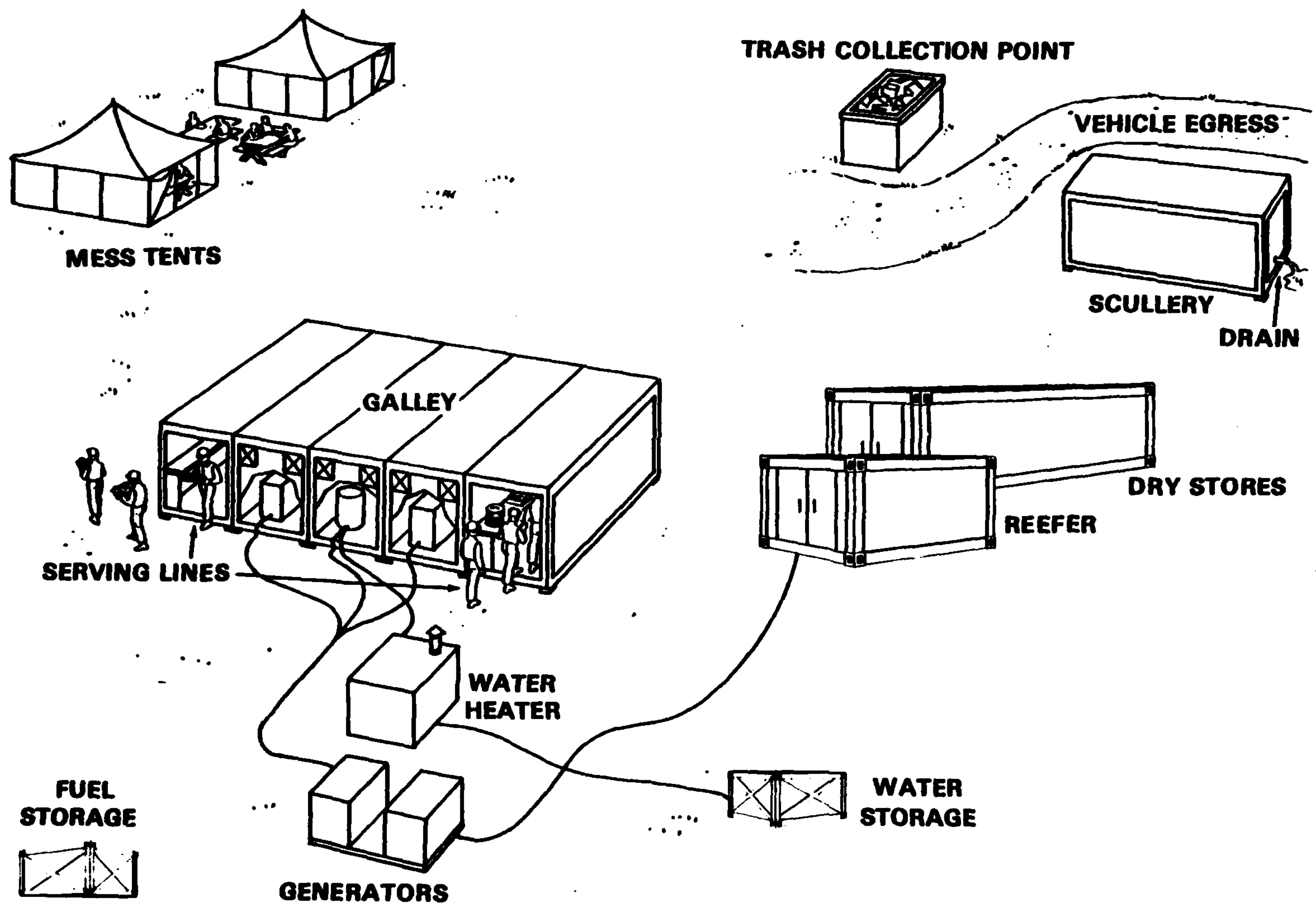

Figure E–4. Field Feeding System (1000-Man MCESS) graded when Marine Corps operations cease. Large shelter dismantling, proper packaging and marking for shipment, and backloading are significant factors for logistics planning considerations.

Shelter Manpower Comparisons. Relative erection times and skill level requirement comparisons for the three large shelters are shown in table E-1. These data are based upon the assumptions and estimates contained in the detailed labor analysis in tab 1.

Table E-1. Large Shelter Erection Comparisons/Manpower Skills

Per Shelter Unit	60'x128'	32'x73'	20'x33'
Man-Days (Off/Enl)*	5.1/140	0.1/43	0.1/14
Elapsed Time (Days)	4/7**	3½	2
Skill Level	Engineer Unit	Engineer Unit	Any Unit—Engineer unit preferred

*Based upon 14 hours/day.
**Without concrete footings/with concrete footings.

The erection of all large shelter assets within a MAF, utilizing current MAF allowances as depicted in the Master Plan, would generate the comparative manpower statistics listed in table E-2.

Table E-2. Large Shelter Erection Times for Total MAF Allowances

	60'x128'	32'x73'	20'x33'
Shelter Allowance/MAF	47	89	153
Man-Days (Off/Enl)	240/6,580	9/3,795	15/2,142
Man-Weeks (Off/Enl)	34/940	1/542	2/306
Man-Months (Off/Enl)	9/235	0.2/136	0.5/77

It is recognized that the erection times are based on different skill levels for each type of shelter; consequently, the data in table E-1 are not valid for direct comparison. The figures shown are conservative estimates and will be refined based upon field data extracted from training exercises and/or actual deployment.

Shelter Manpower Ratings (Erection Labor). Using the man-days associated with the erection of each of the large shelter sizes, the labor output relationship between the three shelters where the 60'x128' shelter is rated as 100 is as follows:

Large Shelter Size	60'x128'	32'x73'	20'x33'
Manpower Rating (MAF IO)	100	58	33
Manpower Rating (single shelter basis)	100	31	10

5.4 Concept of Operation for Small Shelters

Tactical considerations tend to be less significant for small shelter employment than for large shelters; however, certain procedural guidelines appear reasonable. This is particularly applicable in the well ordered scheduling of equipment for transport and handling of a MAF's total small shelter allowance, which is of considerable magnitude.

Small shelters will be emplaced with protective measures as the tactical situation permits. Shelters located closer to the Forward Edge of the Battle Area (FEBA) will stress defilade positioning, camouflage, and sandbagging to the maximum except where frequent displacement makes such considerations secondary (figure E-5). Infantry and artillery regimental areas should maximize small shelter complexing and field fortificatior treatment. Climate, terrain, and enemy air capability will further influence camouflage and complexing of small shelters.

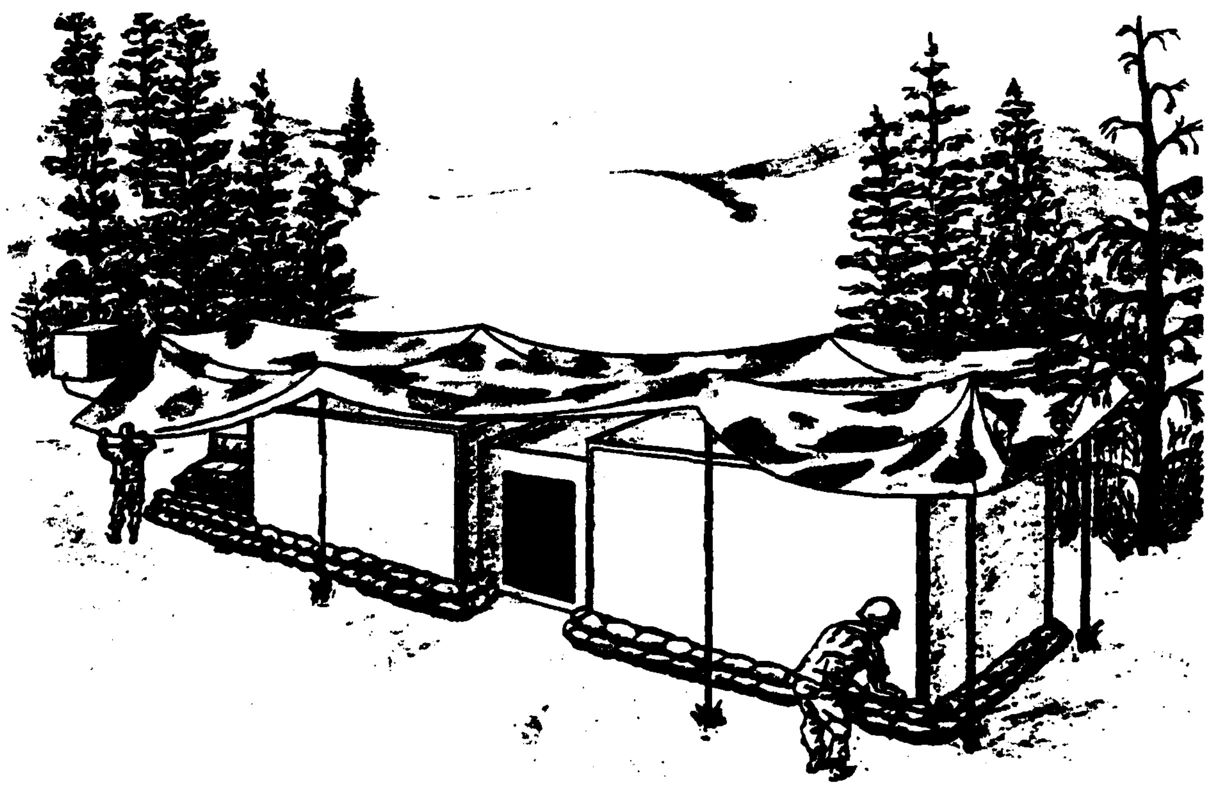

Figure E-5. Shelter Positioning

The small shelters will generally be transported directly to sites, either by helicopter or logistics vehicle. Unloading will be accomplished with appropriately sized forklifts or cranes. Employment of motor transport and MHE will require coordinated dispatching and scheduling. In this area, additional training may be required to ensure that dispatching personnel ensure the inherent efficiency of the equipment in use. There will be increased communication requirements among equipment operators, dispatchers, and staff echelons to effectively use assigned assets in response to the tactical-logistics situation.

Site reconnaissance will take on additional importance for shelters as compared to previous efforts for tentage. Obvious difficulties in placing shelters in rocky or steeply sloped areas are envisioned and leveling work with hand tools or earthmoving equipment will be required. The majority of small shelter installations will be accomplished by the using unit. Use of engineer support equipment and personnel will be required, when command and control centers, communications, and other critical functions are required to be "dug in" and shielded. For details of small shelter erection, refer to "Small Shelter Manpower/Labor Analysis", Northrop Services, Inc., dated 15 July 1980.

5.5 Beach Support Area (BSA) Considerations

The buildup of supplies and services within the BSA will be inversely proportional to whether CSSAs are prepared to accommodate the storage requirements dictated for each class of supply. Movement of commercial containers, arriving from AFOE shipping, could conceivably remain in the beach container handling/storage areas if MSR development and/or CSSA terrain/site were inadequate. Site reconnaissance objectives such as drainage, egress to MSR, and acreage must be considered when selecting primary or alternate sites as container storage areas. In addition, truck/trailer turnarounds and unloading area conditions will be even more important where heavier loads and larger volumes are involved. Staging areas for retrograde containers must be established to accommodate the planned availability and scheduling of turnaround shipping. Ideally, commercial containers will move directly from elevated causeways on the same logistics vehicle to a predetermined site inland. However, the preparation time and degree of CSSA completion, as well as other factors, may dictate that containers be offloaded from the trailer in the beach container storage area. The containers would be stripped, their contents stored in appropriate dumps, and the empty containers dispatched to a container retrograde area. Unit PALCONs, QUADCONs, and outsize cargo would be forwarded to their assigned units or parent units as the tactical situation allowed.

Centralized Dispatching and Coordination. The use of combined helicopter and ground transportation modes for delivery of critical classes of supply would be the same as in current operations. However, the considerations in dispatching vehicles or equipment to accomplish a specific job would differ somewhat from current methods. For instance, the call to a division motor transport office to move a water container to the water supply point would no longer be satisfied in the current manner. Since the 1,000-gallon storage module would be the FLS water container, the unit dispatcher would be well advised to ascertain if the module were empty, and if not empty, to determine its approximate volume. At 6 to 7 pounds-per-gallon for fuel or water, respectively, the dispatcher must select the proper size forklift or crane to load his truck. Liaison may be required with other supporting units. Also, the use of proper equipment is essential to an effective operating organization and providing it from unit assets may not be an option as in the past. Therefore, improved training, communication, coordination, and prior daily/weekly logistics operational planning will be mandatory if logistics support success is to be ensured. Increased management emphasis towards preventive maintenance will be necessary in order to ensure equipment availability to reduce operational deadlines. Geographic (grid coordinates) pinpointing of MHE and transport assets and accurate operational status information of such equipment will be an absolute necessity to logistics staffs at all levels of command.

<u>Road Nets—Construction and Maintenance</u>. The motor transport loads of up to 34 tons will cause increased demands upon road construction and road maintenance for engineer units. The attention to upgrading existing roadways, turnarounds, shoulders, drainage ditches, culverts, and by-passes will place increased demands upon construction equipment such as graders, compaction equipment, dump modules/dump trucks, as well as borrow pit/river run gravel/quarry operating and loading equipment. Alternatives to moving heavy container loads would be to unstuff containers in areas such as the BSA and transport lighter loads to accommodate existing road and bridging assets until upgrading and additional construction consistent with heavy load demands is accomplished. Engineer task priorities and resource availability will te.per road and bridge conditions in MAB and MAF operations.

6. SUMMARY/CONSIDERATIONS

The major underlying consideration in the FLS oriented logistics concept of operation is an increased demand on the logistics planner at every level of the FMF. Greater attention to detailed planning, scheduling, and equipment interdependencies must be ensured. Responsiveness to logistics support and service demands may be degraded unless careful coordination of all assets is provided. Centralized control will be a necessity. Support requirements of combat units must be continually monitored by logistics planners in order to maintain flexible and responsive logistics support. This logistics support is generally interpreted by the casual observer in terms of motor transport and material handling assets.

However, many of the service support functions require an external power source, fuel, and/or water. This ancillary support must be integrated into the overall scheme.

The identification and tracking of equipment and material will require increased effort. Potential use of computer-aided containerized cargo/inventory control should be explored. Instead of current mobile loading techniques, much of the cargo will be loaded in shelters/containers/QUADCONs/PALCONs and transported by logistics vehicles. Transport flexibility will not be decreased, provided requirements are properly articulated and coordinated effectively in a timely manner by all cognizant staff agencies. A logistics training program, including command post exercises oriented to combat service support functions, is considered to be mandatory. Field training problems are also required to exercise all areas of logistics support. The conversion to FLS is an evolutionary procedure that will enhance the logistics support of the FMF, provided adequate orientation and training are afforded to all levels of command.

TAB 1 TO APPENDIX E

SHELTER MANPOWER LABOR ANALYSIS
LARGE SHELTER FAMILY

(Estimates of manpower/labor requirements and scheduling associated with the erection of the 60'x128', 32'x73', and 20'x33' large shelters)

NOTE

Recent operational tests of the 60'x128' shelter were conducted at MCAGCC, Twentynine Palms, California, utilizing self-locking screws to secure the shelter sill plate to AM-2 matting. These tests indicate it may be possible to eliminate the concrete footing requirement for the shelter noted within this analysis. Further operational tests in various environments and soil strata, however, should be conducted to validate this technique.

SHELTER MANPOWER LABOR ANALYSIS
LARGE SHELTER FAMILY
(60'x128')

The largest shelter configuration is a 60'x128' structure that normally requires concrete footings. When shelter sites are selected on existing hardstands, the use of 7/8" lead anchors or other expedients may be considered in lieu of footings. Erection is considered to be a task assigned to force or wing engineer units.

The base case for manpower allocation to perform 60'x128' shelter erection is as follows:

<u>2 Days</u>

- Site reconnaissance/selection
- Site survey-grade stakes
- Site preparation
  - Grading (rolling equipment/handwork)
  - Digging foundation/forming/set bolts
  - Survey check

<u>2 Days</u>

- Pour foundation/cure time/stage shelter for erection

<u>3 Days</u>

- Commence erection
- Complete erection
- Hook up electrical power

The above sequence does not include deck treatment within the shelter floor space or outside hardstand/soil treatment. Large shelter componentry does not include materials for decking. Options available would range from concrete to matting to various levels of soil stabilization (AMSS, cement, petroleum-base dust control, or water dust control).

Estimated hours of labor by specific military occupational skills within occupational fields 11, 13, and 14 are indicated. Although the 60'x128' shelter is considered strictly as an engineer unit assignment for erection and dismantling, it does not necessarily follow that other (nonengineer) personnel cannot be trained to assist or supervise such a task. In the event nonengineer personnel were involved, greater risks in safety, material/shelter damage, and extended labor hours would be of consequence.

Minimum equipment and personnel estimates are as follows:

Equipment

1 Crane (with special slings)
1 RTF, 6,000-pound
1 Concrete mixer
1 Compressor with vibrator attachment
1 Grader
Handtools, handsaws, and cutting torch with gas cylinders
Scaffolding

Material Listing

Sand, gravel, cement, and water (12 cubic yards concrete/60'x128')
3/8-inch reinforcing bar (steel)
Forming lumber, wire ties, nails

Personnel

Combat engineers (26) and engineer officer (1)
Equipment operators (5)
Survey party (3)
Electrician (1)

Erection Schedule/Labor Distribution (14 hours/day)

Qty	Grade	MOS	Hours		Comment
1	01/02	1302	70	(5 days)	OIC shelter erection project
1	03	1302	1		Ass't S-3 or company commander
*26	E1-E7	1371	1,802	(5 days)	Site preparation, form, pour, erection (Materials unload, stage, erection)
2	E3/E4	1345/71	112	(4 days)	Crane and forklift operations
1	E3/E4	1345	15	(1 day)	Concrete mixer, compressor, grader
1	E3/E4	1316	5		Cut re-bar
1	E3/E4	1141	5		Power hookup-check
3	E3-E7	1421/22	18	(½ day)	Initial survey, stakes, re-bar and reche

* Days 1 through 3 utilize a 26 man detail. Starting on day 4, the work crew strength is 13 and remains at that level through the last day of erection.

	Day 1	Day 2	Day 3	Day 4**	Day 5	Day 6	Day 7
Site Recon.	X—X						
Site Survey	X—X	X——X					
Grading	X——X						
Forming*	X——	——X					
Pour Concrete			X——X				
Concrete Cure			X——	——X			
Shelter Staging				X——X			
Erection					X——	————	——X
Electrical Power Installation							X—X

* This task does not include pre-cut forms and pre-cut re-bar but assumes forms are fabricated onsite and re-bar is cut onsite

** Day four requires only five men and RTF operator.

Labor Totals/(Shelter 60'x128')

	Officer	Enlisted
Hours	71	1,957
Man-Days (14 hours/day)	5.1	140
Occupational Fields	13	11, 13, 14
MOS	1302	1141, 1316, 1345, 1371, 1421, 1422

Assumptions

- The active duty MAF allowance is 52 shelters (60'x128').
- MAF logistic concept of operation requires 60'x128' shelter assets erected and operative between D+10 and D+45.

Discussion

Based upon the foregoing analysis and labor hours associated with the 60'x128' erection, the base case for total labor translated to 3,692 officer hours and 101,764 enlisted hours for 52 shelters. Using a factor of 14 hours/day and 7-day weeks, the total labor translates as follows:

	Officer	Enlisted
Man-Days	264	7,269
Man-Weeks	38	1,038
Man-Months	10	260

Conclusions

If an effective force of 5 officers and 150 men equates to a company, then it can be postulated that a Marine engineer company or naval construction company would require approximately 2 months or two companies would require 1 month to accomplish the foregoing shelter erection. Although 2 companies could erect the 55 shelters in approximately 30 days, the obvious degradation of the engineer support roles normally provided within the AOA becomes a questionable trade-off. The ongoing Engineer Mission Analysis study appears to be an ideal vehicle to identify and examine those current tasks which could be considered for such a trade-off. It is recognized that in the assignment of any engineer unit or units to a shelter erection repetition, a proficiency level will accelerate to a maximum point, and that other efficiencies of scheduling equipment, forming crews, surveying, material staging, concrete mixing/distribution, etc., will result. However, it should be noted that this analysis does not include interior deck surfacing treatment of any type or surface treatments adjacent to the shelter sites. Further, if consideration is given to the disassembly/dismantling and orderly repackaging of 60'x128' shelter components for transfer, reuse and/or backloading, the labor considerations for a complement of 52 shelters is estimated conservatively at 3–4 weeks using two trained engineer companies.

Recommendations

- That 60'x128' shelter erection requirements be incorporated into the current engineer construction requirements. Further, that shelter erection tasks be incorporated into appropriate Marine Corps training curriculum.
- That an evaluation be conducted of the effect of projected FLS large shelter allowances on ABFC requirements.
- That shelter erection personnel and MOS requirements be examined vis-a-vis other tasks assigned engineer units.
- That availability of personnel be considered in shelter inventory objective adjustments based on MAF facility planning objectives, Advanced Base Functional Component planning objectives, and erection scheduling in the AOA.
- That consideration of shelter reductions in MAF allowances be a primary alternative if shelter erection manpower requirements are validated through field exercises.

SHELTER MANPOWER LABOR ANALYSIS
LARGE SHELTER FAMILY
(32'x73')

The mid-size shelter measures 32'x73' and does not require the same erection techniques as the 60'x128' unit. Although sill plates are required on a level surface, concrete footings are not needed. FMF engineer units are normally required to erect this shelter; however, specifically trained personnel in other occupational fields may also be used. In the latter situation, supervisory personnel should be furnished by an engineer unit.

This shelter has been erected by FMF engineers during operational tests. The erection exercise compared closely with previous analytical estimates. This labor analysis update is in concert with the total manhours reported by the FMF unit. Accordingly, the base case for manpower allocation to erect a 32'x73' shelter is as follows:

½ Day

Site reconnaissance/selection

Site survey-grade stakes

Site preparation

- Grading (rolling-compaction equipment/handwork)
- Survey check

3 Days

Commence erection

Complete erection

Hook up electrical power

The above sequence does not include deck treatment within the shelter floor space or outside hardstand/soil treatment. In this regard, available options range from concrete to matting to various levels of soil stabilization (AMSS, cement, petroleum-base dust control, or water dust control).

Estimated hours of labor by specific military occupational skills within occupational fields 11, 13, and 14 are indicated. Although the 32'x73' shelter would ideally be treated as an engineer unit assignment for erection and dismantling, it does not necessarily follow that other (nonengineer) personnel cannot be trained to assist or supervise such a task. In the event nonengineer personnel were involved, greater risks in safety, material/shelter damage and extended labor hours would be of consequence. It is therefore recommended that a trained SNCO (1371) be assigned to supervise troop labor in the event nonengineer units are assigned to erect or dismantle this shelter.

Minimum equipment and personnel estimates are as follows:

Equipment

1 Crane (with special slings)
1 RTF, 6,000-pound
1 Grader/compaction equipment based on soil conditions
Handtools, spreader bar
Scaffolding

Personnel

Combat engineers (10), staff NCO (1) and engineer officer (1)
Equipment operators (3–4)
Survey party (3)
Electrician (1)

Erection Schedule/Labor Distribution (14 hours/day)

Qty	Grade	MOS*	Hours		Comment
1	01/02	1302	1		Plt. commander or company commander
1	E6/E7	1371	49	(3½ days)	NCOIC shelter erection project
10	E1–E5	1371	420	(3 days)	Site preparation, erection (Materials unload, stage, erection)
2	E3–E4	1345	98	(3½ days)	Crane and forklift operations
1	E3/E4	1345	6	(½ day)	Grader, compaction equipment
1	E3/E4	1141	6	(½ day)	Power hookup-check
3	E3–E7	1421/22	18	(½ day)	Initial survey, stakes, recheck after grading

*Preferred MOSs are shown; however, NCOIC as 1371 is recommended as a mandatory skill. Possible solution is MOS training in shelter erection at NCO level and additional MOS designator for that skill.

The schedule for erection is as follows:

	Day 1	Day 2	Day 3	Day 4
Site Recon.	X—X			
Site Survey	X———X			
Grading	X———X			
Shelter Staging	X–(4 men)–X			
Erection	X———	(10 men)———	———	———X
Electrical Power Installation			X———	———X

<u>Labor Totals/(Shelter 32'x73')</u>

	Officer	Enlisted
Hours	1	597
Man-Days (14 hours/day)	0.1	43
Occupational Fields*	13*	11, 13*, 14
MOS	1302	1141, 1345, 1371*, 1421, 1422

*Recommended that SNCO 1371 be assigned as NCOIC when nonengineer units are assigned to erect or dismantle. Officer inspection by 1302 is also recommended.

<u>Assumptions</u>

- The active duty MAF allowance is 89 shelters (32'x73').
- MAF logistic concept of operation requires 32'x73' shelter assets erected and operative between D+10 and D+45.
- All shelter assets are sited within the AOA, which is a 600-square-mile land mass.

<u>Discussion</u>

Based upon the foregoing analysis and labor hours associated with the 32'x73' erection, the base case for total labor translates to 89 officer hours and 53,133 enlisted hours for 89 shelters. Using a factor of 14 hours/day and 7-day weeks, the total labor translates as follows:

	Officer	Enlisted
Man-Days	9	3,795
Man-Weeks	1	542
Man-Months	N/A	136

Conclusions

If an effective force of 5 officers and 150 men equates to a company, it can be postulated that a Marine Company with adequate shelter training would require approximately 4 weeks to accomplish the foregoing shelter erection. Although the unit could erect the 89 shelters in 4 weeks, the obvious degradation of engineer support roles normally provided within the AOA becomes a questionable trade-off. An engineer mission analysis study might be useful to identify and examine those current tasks which could be considered for such a trade-off.

It is recognized that in the assignment of an engineer unit or other units to a shelter erection repetition, the proficiency level will accelerate to a maximum point, and that other efficiencies of scheduling equipment, surveying, material staging, crane lifting operations, etc., will result. However, it should be noted that this analysis does not include interior deck surfacing treatment of any type nor surface treatments adjacent to the shelter sites. Additionally, if consideration is given to the disassembly/dismantling and orderly repackaging of 32'x73' shelter components for transfer, reuse, and/or backloading, the labor considerations for a complement of 89 shelters is estimated conservatively at 2 weeks, using an engineer company. When coupled with the manpower requirements for the 60'x128' shelter, it appears that approximately 3 engineer or naval construction battalion companies would be engaged full time for 3 to 4 weeks to erect all the MAF 60'x128' and 32'x73' shelters within the D+10 to D+45 time frame.

Recommendations

- These shelter erection requirements should be examined vis-a-vis other engineer tasks to determine whether such units should be released for the erection of 32'x73' shelters.
- That "additional" MOS training for 1371 "shelter supervisor qualifications" be examined with skill identification alternatives proposed, such as service record administrative entry, etc.
- That consideration to shelter reduction in MAF allowances be a primary alternative if shelter erection manpower requirements are validated through field exercises.

SHELTER MANPOWER LABOR ANALYSIS
LARGE SHELTER FAMILY
(20'x33')

The smallest shelter of the large shelter family is the 20'x33' size. This shelter does not require concrete footings, as does the larger 60'x128' shelter; however, sill plates are required as with the 32'x73' size. Additionally, a level, graded surface is required, and compacted soil is beneficial to stabilize the structure and provide an effective work surface area.

FMF engineer units within wing or force organizations are not required to erect this shelter; however, it is a preferred course of action to assign engineer personnel in a supervisory capacity during erection or dismantling of this shelter. In all cases of erection or dismantling, a SNCO 1371 supervisor is recommended when nonengineer personnel are assigned.

Accordingly, the base case for manpower allocation to perform the erection of a 20'x33' shelter is as follows:

½ Day

Site reconnaissance/selection

Site survey-grade stakes

Site preparation

- Grading (rolling-compaction equipment/handwork)
- Survey check

1½ Days

Commence erection

Complete erection

Hook up electrical power

The above sequence does not include deck treatment within the shelter floor space or outside hardstand/soil treatment. Options available would range from concrete to matting to various levels of soil stabilization (AMSS, cement, petroleum-base dust control, or water dust control).

Estimated hours of labor by specific military occupational skills within occupational fields 11, 13, and 14 are indicated. Although the 20'x33' shelter generally would be considered as an organic unit assignment for erection and dismantling, it does not necessarily follow that engineer personnel could not assist or supervise such a task. Since involvement of nonengineer personnel would be the rule (based upon using units being responsible for erection or dismantling), greater risks in safety, material/shelter damage, and extended labor hours could be of consequence. Therefore, extensive unit training and exercises utilizing the 20'x33' shelter would be required. A trained SNCO (1371) should be assigned to supervise troop labor during erection or dismantling of this shelter.

Since only one 20'x33' shelter has been completely erected to date (Pascoe, 1978), the man-hour requirements indicated below must be considered as an initial baseline estimate. The erection at Pascoe did not involve grading or staging, and was performed without the use of a crane. The erection took 96 hours. Including staging time (material staging, inventory check, etc.), an additional 9 man-hours has been added to this total.

In addition, a crane is recommended for normal erection operations to ensure proper handling, minimize damage, and provide personal safety.

Therefore, the equipment and personnel estimates are as follows:

Equipment

1 Crane
1 RTF, 6,000-pound
1 Grader/compaction equipment based on soil conditions
Handtools

Personnel

Marine enlisted (5), staff NCO (1), and officer (1)
Equipment operators (3–4)
Survey party (2)
Electrician (1)

Erection Schedule/Labor Distribution (14 hours/day)

Qty	Grade	MOS*	Hours		Comment
1	E5/E6	1371	28	(2 days)	NCOIC shelter erection project
1	01/02	All	1		Plt. commander or company commander
5	E1–E4	All	105	(1½ days)	Site preparation, erection (Materials unload, stage, erection)

Erection Schedule/Labor Distribution (14 hours/day)—Continued

Qty	Grade	MOS*	Hours	Comment
2	E3–E4	1345	56 (2 days)	Crane and forklift operations
1	E3/E4	1345	3 (¼ day)	Grader, compaction equipment
1	E3/E4	1141	3 (¼ day)	Power hookup-check
2	E3–E7	1421/22	4 (1/3 day)	Initial survey, stakes recheck after grading

*Preferred MOSs are shown; however, NCOIC as 1371 is recommended as mandatory skill. Possible solution is MOS training in shelter erection at NCO level and additional MOS designator for that skill.

	Day 1	Day 2
Site Recon.	X—X	
Site Survey	X——X	
Grading	X——X	
Shelter Staging	X—(4 men)—X	
Erection*	X————————	——(5 men)———X
Electrical Power Installation		X—X

*Plus Equipment Operators

Labor Totals/Shelter 32'x73'

	Unit Officer	Enlisted
Hours	1	200
Man-Days (14 hours/day)	0.1	14
Occupational Fields*	All applicable	11, 13*, 14
MOS*	All applicable	1141, 1345, 1371*, 1421, 1422

*Recommended that SNCO 1371 be assigned as NCOIC when nonengineer units are assigned to erect or dismantle.

Assumptions

- The active duty MAF allowance is 154 shelters (20'x33').
- MAF logistic concept of operation requires 20'x 33' shelter assets erected and operative between D+10 and D+45.
- All shelter assets are sited within the AOA, which is a 600-square-mile land mass.

Discussion

Based upon the foregoing analysis and labor hours associated with the 20'x33' erection, the base case for total labor translated to 154 officer hours and 30,800 enlisted hours for 154 shelters. Using a factor of 14 hours/day and 7-day weeks, the total labor translates as follows:

	Officer	Enlisted
Man-Days	11	2,200
Man-Weeks	1.6	314
Man-Months	N/A	79

Conclusions

If an effective force of 5 officers and 150 men equates to a company, it can be postulated that approximately one-half of a company with adequate training would be required to erect all 20'x33' shelters rated by a MAF within a month. Normally, such an outlay of manpower could be spread between those units rating the shelter. Another alternative to spreading the manpower labor requirement across all units rating the shelter would be to dedicate a unit or units (composite company or otherwise) to complete all 20'x33' erections within a scheduled time frame in accordance with a planned siting scheme. (The advantage to this latter method is to gain learning curve expertise and efficiencies therein.)

Recommendations

- These shelter erection personnel requirements should be examined vis-a-vis other tasks normally required of units which rate the 20'x33' shelter.
- Those MOS requirements for equipment operators, surveying personnel, and electricians should be analyzed for availability when considering other normally required tasks.
- That "additional" MOS training for 1371 "shelter supervisor qualifications" be examined with skill identification alternatives proposed, such as service record administrative entry, etc.